Dolby® Digital Two-Channel Consumer Broadcast Products Test Procedure

Issue 3

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Chapter 1
Introduction

This test procedure defines evaluation of two-channel and multichannel consumer digital broadcast products. Methods for testing Dolby® Digital decoding are defined in this procedure. It also defines the evaluation of the two-channel analog and the digital audio outputs of a product

Multichannel—or 5.1-channel—units must be evaluated with this test procedure, the addendum for 5.1-channel products, and with the Pro Logic® test procedures. For assistance, please contact Dolby Laboratories.

Product Type	Evaluation Procedure		
	Two-Channel Test Procedure	Multichannel Test Procedure	Pro Logic Test Procedure
Two-Channel	√		
Multichannel	√	√	√

The testing objective is to determine both the product's audio performance and to ensure its compliance with required features. The quality and correct operation of the Dolby Digital decoding and the digital-to-analog conversion are checked. Also, correct operation of the unit's IEC 61937 output is tested and verified with an external decoder. (In this document, the terms S/PDIF, IEC 958, IEC 1937, and IEC 61937 are synonymous and will be referred to as IEC 61937.)

The evaluation can be broken into four steps:

- Verification that the artwork, trademarks, and features provided are correct and used in the proper context. (See *Licensing Information Manual*; General Information.)
- Testing for proper Dolby Digital two-channel decoding and analog circuitry performance using the analog outputs with test signals that have been created from the supplied.ac3 files.
- Testing waveform quality of IEC 61937 outputs and compatibility with external decoders.
- Performing listening and functional tests to ensure the product operates in a manner consistent with consumer expectations.

Please refer to the current *Dolby Digital Consumer Decoder Licensee Information* manual for general product requirements.

To begin the testing process at Dolby Laboratories, the unit in question must be able to reproduce all test signals described in this document. The front panel and remote control should be functional. All analog and digital outputs must be in working order.

The following items should be supplied either with the sample or before it is submitted. This will minimize any delay in the testing process.

- Schematics, block diagrams, and complete test data
- A list of known hardware or software problems (if any)
- An owner's manual. (If the manual is not available in English, please submit complete operating instructions in English.)
- Cards or keys for accessing satellite and/or cable programming

Upon receipt of the product, we will conduct a short functionality test and confirm that the unit is in working order. We will advise you that the unit has been received and provide an estimated date of completion.

This document covers the primary tests that are performed on the unit, but it does not necessarily cover every test that may be conducted during final evaluation at Dolby Laboratories. Preliminary testing to ensure that the unit works correctly will greatly increase the chances of gaining approval with the first sample. Please complete this evaluation of your product before sending a sample to us for final evaluation and approval. We expect the overall performance of the product to meet the standards that consumers associate with our name.

1.1 Procedure Overview/Test File Information

The following test suite is designed to evaluate the performance of a two-channel product that incorporates Dolby Digital technology. Tests include checks for proper operation of compression, dialog normalization, and downmix along with more traditional audio quality testing.

1.1.1 Required Test Equipment

Audio Precision® System 2, model 2322 running APWIN version 2.11 software.

- AP Optional Filters Used
CCIR-2k   *Part #* FIL-CCR
20 kHz Apogee lowpass Brickwall   *Part #* FLP-A20K
- Oscilloscope (two-channel)
- External 5.1-channel Dolby Digital decoder
- Input generator (such as an MPEG transport stream player)
- 8-ohm resistive load (if product contains speaker outputs)
- 32-ohm resistive load (if product contains headphone outputs)

> **Note:** An Audio Precision System 1 can be used for the analog tests only. Contact Dolby Laboratories for correct System 1 file templates. We recommend that APWIN.ver.1.52 be available for use with Frequency Response and THD vs. Frequency tests. The APWIN.ver.1.52 test files needed are located on the *Test Kit Ver.2.0 DVD* in the *AP Test Files* folder. Contact Dolby Laboratories for assistance.

Each test generally includes two filenames, the .ac3 (Dolby Digital) test signal file and the .at2 (Audio Precision) file. The .ac3 files must be processed into an appropriate form to meet the decoder's input requirements. MPEG-2 Transport Streams (.trp) with .ac3 (Dolby Digital) files are included on the Test Disc provided. (See the Transport Stream List on the *Dolby Digital Two-Channel Consumer Broadcast Products Test Kit Version 2.0* DVD.)

The .at2 files are templates containing AP test parameters for the analog, digital, and functional tests. Open the .at2 files with APWIN software running on the Audio Precision (AP) system computer.

1.1.2   Test Signal File Names

2_997_L.ac3	2_aswp4ka.ac3	acmodswp.ac3
2_997_R.ac3	2_aswp41a.ac3	acmswpvo.ac3
2_ref2k.ac3	advtest.ac3	Diffmus1.ac3
2_dnsweep.ac3	2_200a60.ac3	Diffmus3.ac3
dwnmix2s.ac3	2_k5comp.ac3	Diffmus5.ac3
dwnmix20.ac3	dtrtall.ac3	Diffmus6.ac3
2fstplr.ac3	ec5.ac3	

1.1.3   Audio Precision Test File Names

2_MaxL.at2	2_997R.at2	digjitw.at2
2_MaxR.at2	2_frqswp.at2	digjitn.at2
2_reflvl.at2	2_thdfrq.at2	chanstat.at2
2_dnswp.at2	2_thdlvl.at2	
2_comp.at2	2_dnr.at2	Additional Files
dwnmix2o.at2	2_nmod.at2	2_frqswp_1-5.at2
dwnmix2s.at2	digeye.at2	2_thdfrq_1-5.at2
2_997L.at2	dighist.at2	2_thdlvl_1-5.at2

1.2   Product Information and Identification

Using the *Test Results* form provided with this manual, note the brand, manufacturer, model number, and sample number (if available) of the unit. Inspect the product and write down its product type, decoder/DAC IC information, and licensed device count. Complete the **Materials Received**, **Features**, and **Test Materials** sections. Check all boxes that apply.

1.3   Trademark and Logo Use

Review all instances of trademark use, including artwork, in the owner's manual, on the product, and in the on-screen menus. In the Trademark Usage section of the *Test Results* form, check all of the applicable items for proper logo reproduction. The double-D symbol and wording should be distinct and the letters should not touch each other. If you are unsure whether your artwork meets our standards, please contact us for assistance. We will be happy to review your logos, switch markings, and on-screen menus. If you do not already have our logo artwork, please contact us and we will send you the appropriate materials.

Check that the required trademark acknowledgment and license notice are on the product and in the owner's manual. The wording and logos within the trademark acknowledgment, license, and copyright notice should be clear and legible. Please refer to the *Dolby Laboratories Licensee Information* manual, General Information section for guidelines on usage.

1.4   Default Mode Setup

Review the default settings for the following parameters and indicate them on the *Test Results* form. The default state is the state the consumer should find their product operating in when they power it up for the very first time.

Operating Mode

- Line Mode
- RF Mode

Downmix Type

- Lt/Rt (surround compatible)
- Lo/Ro (stereo, recommended with RF output)

Digital Output

- Automatic Switching (recommended: Automatic Switching means the product automatically decodes Dolby Digital when available.)
- Dolby Digital
- PCM

Chapter 2
Analog Domain Tests

The following analog domain tests are measured from the analog line outputs. Connect the product's line outputs to the analog inputs of the AP with the Left channel to input A, and the Right channel to input B.

If the product *only* contains speaker outputs, perform all of the tests (skipping Test 1 and Test 2) at the speaker outputs. Record the results of each test on the *Test Results* form.

2.1   Test 1: Maximum Output Level (Left Channel)

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
2_MaxL.at2	2_997_L.ac3	Mux01-3	30 sec	1 kHz at 0 dBFS Left Channel

Note: Perform this test at all line outputs. It is not necessary to perform this test at speaker outputs. For variable line outputs, please set the volume control to maximum.

Test 1 determines the maximum output level from the Left channel that the product is capable of generating. Each channel (Left and Right) is tested independently to avoid the effects of compression and other overload protection.

This test signal is a 1 kHz sine wave at 0 dBFS in the Left channel only. While playing the test signal, monitor the Left output of the product. Note the rms voltage level produced from the Left channel in the AP Analog Analyzer window. Record this value on the *Test Results* form.
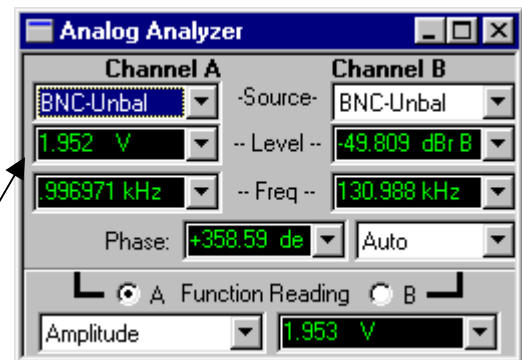
2.2   Test 2: Maximum Output Level (Right Channel)

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
2_MaxR.at2	2_997_R.ac3	Mux01-4	30 sec	1 kHz at 0 dBFS Right Channel

Note: Perform this test at all **line** outputs. It is not necessary to perform this test at speaker outputs. For variable line outputs, please set the volume control to maximum.

Test 2 determines the maximum output level from the Right channel that the product is capable of generating. Each channel (Left and Right) is tested independently to avoid the effects of compression and other overload protection.

This test signal is a 1 kHz sine wave at 0 dBFS in the Right channel only. While playing the test signal, monitor the Right output of the product. Note the rms voltage level produced from the Right channel in the AP Analog Analyzer window. Record this value onto the *Test Results* form.
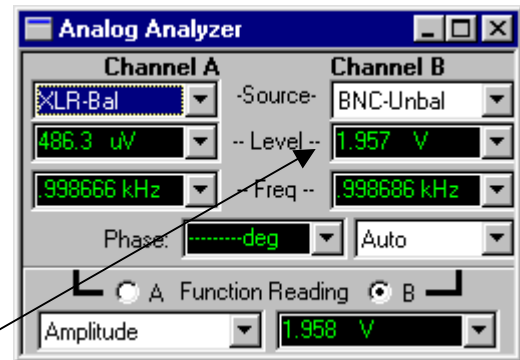
2.3   Test 3: Reference Level

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
reflvl.at2	2_ref2k.ac3	Mux01-5	30 sec	2 kHz at –20 dBFS Stereo

Test 3 obtains the reference voltage level for a full-scale signal from the analog outputs. The reference level found here will be used as a reference for full scale (0 dBFS) in every test unless otherwise noted.

Since compression can affect the level of a full-scale tone, this test uses a –20 dBFS sine wave input and scales the output result by +20 dB. The final value is the theoretical full-scale output level without compression.

For example, the test track is played and a 200 mV reading is taken. This value is then scaled by +20 dB, yielding a 2.00 V reference. While playing the test stream 2_ref2k.ac3, press **F4** on the keyboard. Within the Analog Analyzer window, note the voltages displayed in References dBr A and dBr B. Multiply these voltages by 10, then record the values in **Reference Levels** section on the *Test Results* form.
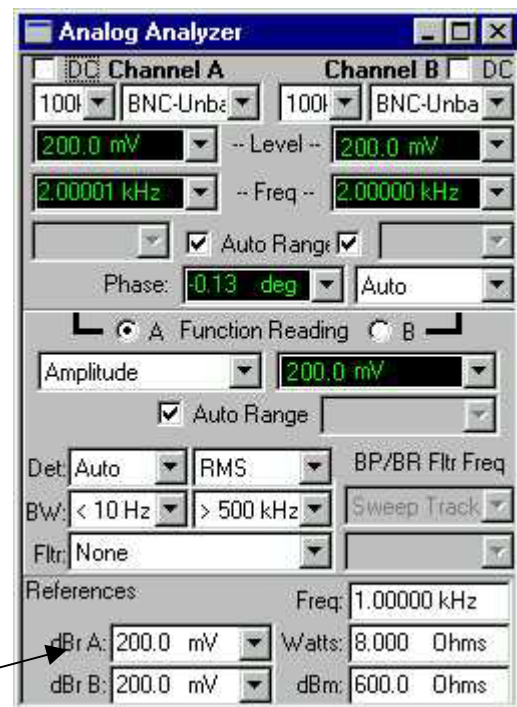
Example: 200 mV x 10 (20 dB) = 2.00 V
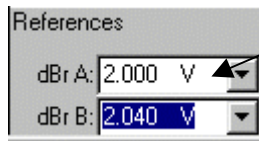
2.4   Test 4: Dialog Normalization

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
2_dnswp.at2	2_dnswp.ac3	Mux02-3	64 sec	1 kHz at 0 dBFS

To begin Test 4, open the AP test file. Enter the **dBr A** and **dBr B** reference levels from Test 3 into the Analog Analyzer panel.
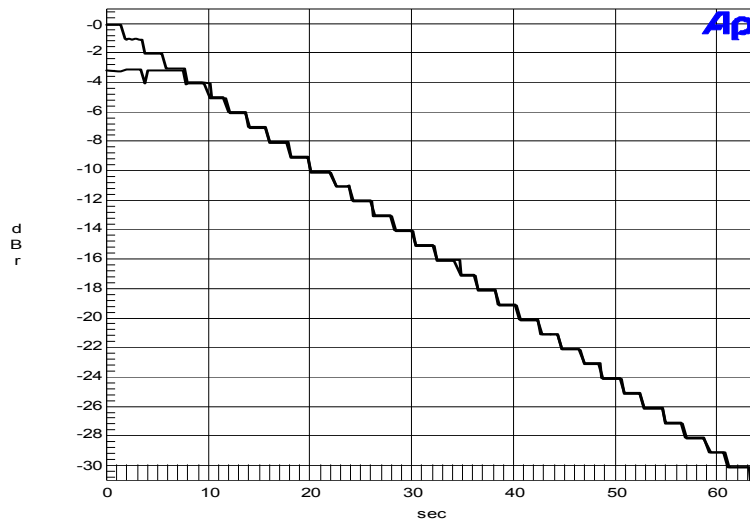
Figure 2-1 Dialogue Normalization

This test signal is a 1 kHz sine wave at 0 dBFS encoded with ACMOD 2/0, dialnorm starting at 31 and decrementing by 1 every two seconds, for a total of 64 seconds. The output of the decoder should also decrease 1 dB every two seconds. This test measures the level of the output and plots it as a 64-second time sweep. The resultant graph should appear as a staircase with each value of dialnorm represented. In RF and Line operating modes some of the first values of dialog normalization will not be represented in the output.

Start the test file and AP sweep simultaneously.

When the test is complete, save the test file: **File**, **Save As**, **Test**. Record the results of this test on the *Test Results* form.

2.5 Test 5: Dynamic Range Compression

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
2_comp.at2	2_k5comp.ac3	Mux04-3	60 sec	400 Hz sweep –60 to 0 dBFS

To begin Test 5, open the AP test file. Enter the dBr A and dBr B reference levels from Test 3 into the Analog Analyzer panel.
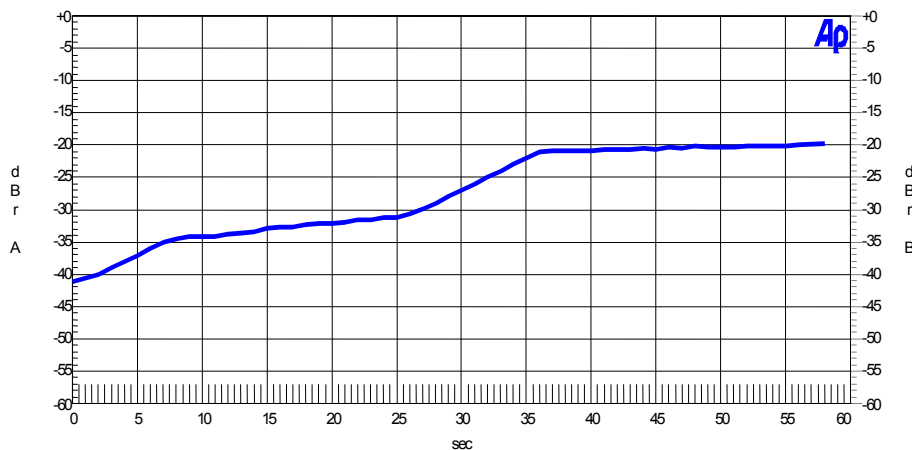
Figure 2-2 Dynamic Range Compression

This test signal is a 400 Hz sine wave, which starts at –60 dBFS and increases to 0 dBFS the rate of 1 dB per second, for a total of 60 seconds. The output of the decoder increases 1 dB per second with no compression applied. Since two-channel decoder employ line mode compression, the output will step for the first 35 seconds, and then flatten off. This result varies with scale factors chosen for Line mode. Similar results are obtained in RF mode operation.

It is important that the AP test be started at the same time as the initiation of test data.

When the test is complete, save the test file: **File, Save As, Test**. Record the results of this test on the *Test Results* form.

2.6 Test 6: Downmix Lt/Rt

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
dwnmix2s.at2	dwnmix2s.ac3	Mux03-3	30 sec	5-400 Hz sine waves at –20 dBFS

To begin Test 6, open the AP test file. Enter the dBr A and dBr B reference levels from Test 3 into the Analog Analyzer panel.

This test verifies an Lt/Rt surround compatible downmix for two-channel decoders. This test signal is five 400 Hz sine waves, with amplitudes near –20 dBFS, and polarity such that when an Lt/Rt downmix occurs, the signals cancel and there is near zero output from each of the two outputs. Use this test to examine the spectrum of the output. Begin playing the test track, and then initiate the AP test. The cancellation should be at least 40 dB, so the maximum output at 400 Hz should be less than –60 dBr. This test usually results in a completely inaudible output, other than noise.

If cancellation does not occur, and levels are still observed to be near –20 dBr, then the product may be using Lo/Ro stereo downmix.

When the test is complete, save the test file: **File**, **Save** As, **Test**. Record the results of this test on the *Test Results* form.
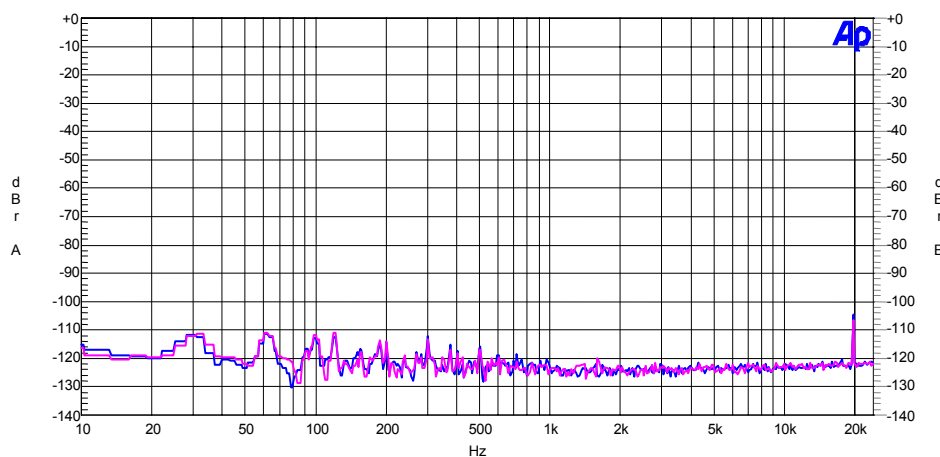
Figure 2-3 Downmix with Cancellation at 400 Hz
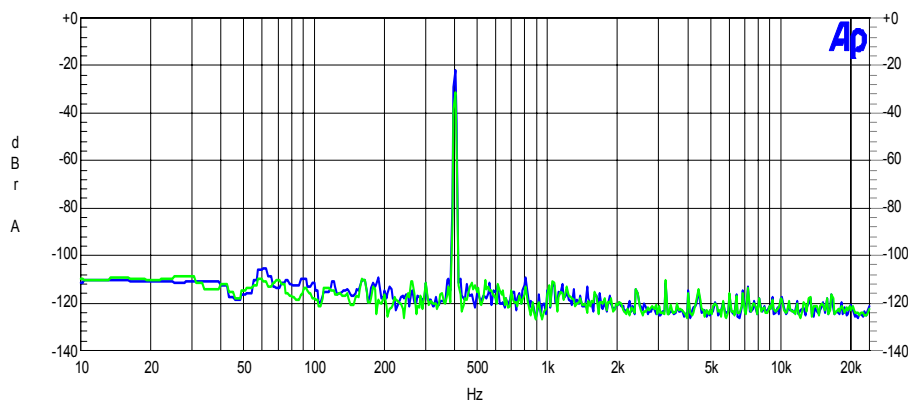
Figure 2-4 Downmix with No Cancellation at 400 Hz

2.7   Test 7: Downmix Lo/Ro

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
dwnmix2o.at2	dwnmix2o.ac3	Mux03-4	30 sec	5-400 Hz sine waves at –20 dBFS

If an RF modulated output is implemented on the unit under test, an Lo/Ro downmix is strongly recommended while in RF operating mode.

To begin Test 7, open the AP test file. Enter the dBr A and dBr B reference levels from Test 3 into the Analog Analyzer panel.

This test verifies an Lo/Ro downmix for two-channel decoders. The test signal is five 400 Hz sine waves, with amplitudes near –20 dBFS, and polarity such that when a Lo/Ro downmix occurs, the signals cancel and there is near zero output from each of the two outputs. Use this test to examine the spectrum of the output. Begin playing the test track, and then initiate the AP test. The cancellation should be at least 40 dB, so the maximum output at 400 Hz should be less than 60 dBr. This test usually results in a completely inaudible output, other than noise.

When the test is complete, save the test file: **File**, **Save As**, **Test**. Record the results of this test on the *Test Results* form.

2.8   Test 8: Left/Right Channel Separation

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
2_997L.at2	2_997_L.ac3	Mux01-3	30 sec	997 Hz at 0 dBFS

Open the AP test file. Enter the dBr A and dBr B reference levels from Test 3 into the Analog Analyzer panel.

Test 8 measures channel separation of the left and right analog outputs in the conventional fashion. The test signal is a 0 dBFS, 997 Hz sine wave in the Left channel, and the test measures crosstalk into the Right channel using a fast Fourier transform.

When the test is complete, save the test file: **File**, **Save As**, **Test**. Record the results of this test on the *Test Results* form.
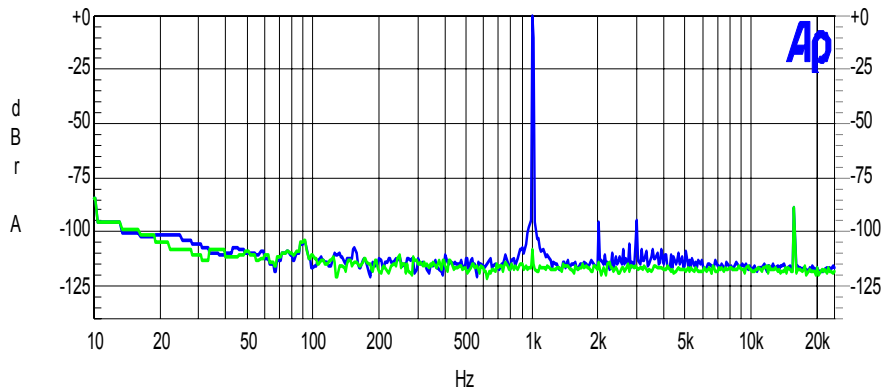
Figure 2-5 Channel Separation

2.9   Test 9: Right/Left Channel Separation

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
2_997_R.at2	2_997R.ac3	Mux01-4	30 sec	997 Hz at 0 dBFS

Open the AP test file. Enter the dBr A and dBr B reference levels from Test 3 into the Analog Analyzer panel.

This test measures channel separation of the right and left analog outputs in the conventional fashion. The test signal is a 0 dBFS, 997 Hz sine wave in the right channel, and the test measures crosstalk into the left channel using a fast Fourier transform.

When the test is complete, save the test file: **File**, **Save As**, **Test**. Record the result of this test on the *Test Results* form.

2.10   Test 10: Frequency Response

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
2_frqswp.at2	2fstplr.ac3	Mux04-4	60 sec	20 Hz to 20 kHz sweep at –20 dBFS

To begin Test 10, open the AP test file. Enter the dBr A and dBr B reference levels from Test 3 into the Analog Analyzer panel.

This frequency response sweep is recorded at –20 dBFS and steps from 20 Hz to 20 kHz logarithmically at approximately 1 step/second. The AP test file operates with this test signal, measures the amplitude and frequency of each segment, and plots the result. The deviation from the 1 kHz reference level should be derived from the graph.

Figure 2-6 Frequency Response

When the test is complete, save the test file: **File**, **Save As**, **Test**. Record the results of this test on the *Test Results* form.
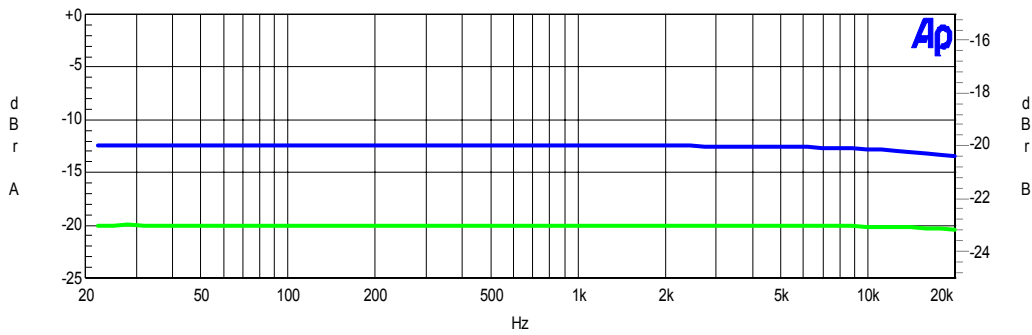

Note: If sweep problems occur with this test, use APWIN Version 1.5 and AP test file 2_frqswp_1-5.at2.

2.11   Test 11: THD+N vs. Frequency

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
2_thdfrq.at2	2fstplr.ac3	Mux04-4	60 sec	20 Hz to 20 kHz sweep at –20 dBFS

To begin Test 11, open the AP test file. Enter the dBr A and dBr B reference levels from Test 3 into the Analog Analyzer panel. This file is now ready to test the Left channel.

When the Left channel test is completed, click Function Reading B in the AP analog analyzer window to switch to Channel B and perform the Right channel test sweep.

This test measures the THD vs. Frequency. The THD is measured in dB relative to full scale, since this mode of presentation is more relevant to audibility of distortion. Record the highest distortion measured for each output channel in the section entitled THD vs. Frequency on the *Test Results* form.

When the test is complete, save the test file: **File**, **Save As**, **Test**.

Note: If sweep problems occur with this test, use APWIN Version 1.5 and AP test file 2_thdfrq _1-5.at2.
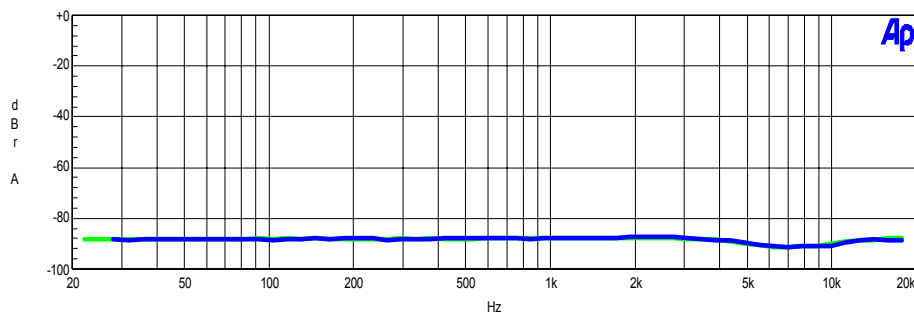
Figure 2-7 THD+N vs. Frequency

2.12 Test 12: THD+N vs. Level

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
2_thdlvl.at2	2_aswp4ka.ac3	Mux05-3	120 sec	4 kHz sweep from 0 to –120 dBFS

To begin Test 12, open the AP test file. Enter the **dBr A** and **dBr B** reference levels from Test 3 into the Analog Analyzer panel. This file is now ready to test the Left channel.

When the Left channel test is completed, click **Function Reading B** in the AP analog analyzer window to switch to Channel B and perform the Right channel test sweep.

This test uses a 4 kHz amplitude sweep from 0 dBFS to –120 dBFS at 1 dB per second. It measures the THD + N relative to full scale, and plots the measurement as a function of time. Since the test file lasts for 120 seconds, the number of seconds on the X-axis of the graph is approximately equal to the level of the 4 kHz sine wave in dB. Initiate the playback of the test signal and the AP test simultaneously. The output will typically decrease slightly for the first 10 to 20 dB, and then reach a low, constant level.

Record the measured level at –20 dB (20 seconds) for each output channel on the *Test Results* form. When the test is complete, save the test file: **File**, **Save As**, **Test**.

**Note**:   If sweep problems occur with this test, use APWIN Version 1.5 and AP test file 2_thdlvl_1-5.at2.
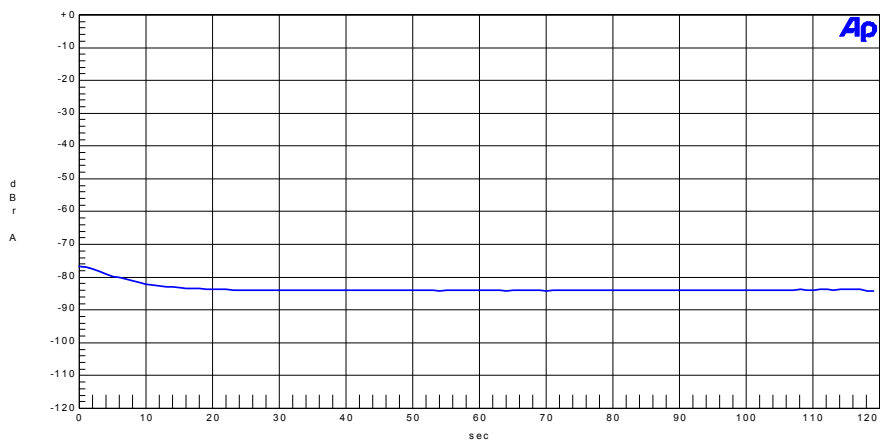
Figure 2-8 THD vs. Level

2.13   Test 13: Dynamic Range

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
2_dnr.at2	2_200a60.ac3	Mux04-5	60 sec	200 Hz at –60 dBFS

To begin Test 13, open the AP test file. Enter the **dBr A** and **dBr** B reference levels from Test 3 into the Analog Analyzer panel. This file is now ready to test the Left channel.

When the Left channel test is complete, click **Function Reading B** in the AP analog analyzer window to switch to Channel B, and perform the Right channel test sweep.

The increase in noise due to the Dolby® Digital decoder and the DACs is measured by playing a test track with a 200 Hz sine wave at –60 dBFS. This test signal is supplied with a precision of 20 bits, with TPDF dither. The spectrum of the noise floor at 4 kHz is then compared to the noise floor at 4 kHz for the original signal. The difference in dB is the noise figure (NF) of the decoder, and indicates how much noisier it is than perfect reproduction.

In order to assess the audible noise floor in the presence of the 200 Hz tone, the fundamental of the signal is notched out with the THD analyzer notch fixed at 200 Hz. The residual is filtered with a 400 Hz highpass filter and weighted with a CCIR 2k filter unity gain at 2 kHz, or with a 20 kHz Apogee lowpass filter. (Refer to Section 1.1.1, *Required Test Equipment*.) This test gives a result that is very close, numerically, to the signal-to-noise ratio measured for an ideal digital audio system.

Record the results on the *Test Results* form. When the test is complete, save the test file: **File**, **Save As**, **Test**.
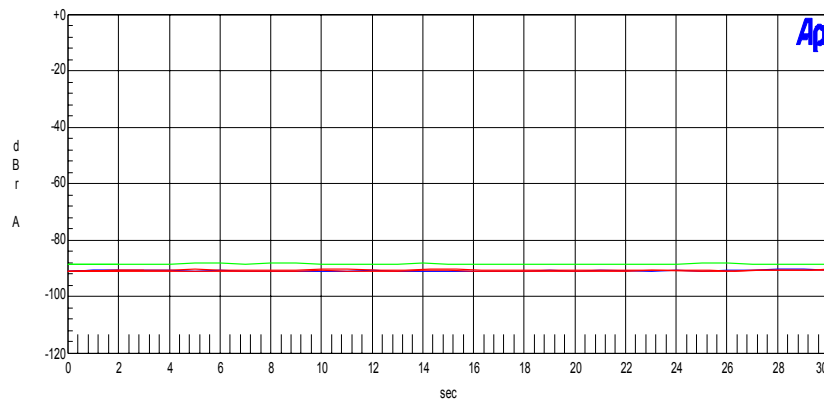
Figure 2-9 Dynamic Range

2.14   Test 14: Noise Modulation vs. Level

AP Test File	Test File	Mux Channel	Duration	Test Signal Description
2_nmod.at2	2_aswp41a.ac3	Mux05-4	120 sec	0 to –120 dBFS sweep at 41 Hz

To begin Test 14, open the AP test file. Enter the dBr A and dBr B reference levels from Test 3 into the Analog Analyzer panel. This file is now ready to test the Left channel.

When the Left channel test is complete, click **Function Reading B** in the AP analog analyzer window to switch to Channel B, and perform the Right channel test sweep.

The test signal is a 41 Hz sine wave that ramps down in level from 0 dBFS to –120 dBFS at 1 dB per second, for 120 seconds. The test measures the change in the noise level at 4 kHz when the test signal is reproduced. Ideally, the noise level will be independent of the signal level. In practice, there will be some increase in noise level for signals very close to full scale.

Measurements are taken after the noise floor reached its final value for signals less than 10 dB below full scale. It is also important that the noise floor not change for signals below that level.

The analyzer uses a 4 kHz bandpass filter to measure the noise level, and plots the measurement as a time sweep. Since the rate at which the signal decays is 1 dB per second, the time axis of the measurement can be read as dB.

Use the *Test Results* form to record the final noise level (after a minimum of 10 seconds) for both the Left and Right, and any change from that level (the noise modulation). When the test is complete, save the test file: **File**, **Save** As, **Test**.

Note: For information on AP filters, refer to Test Equipment Required in Section 1.1.1.
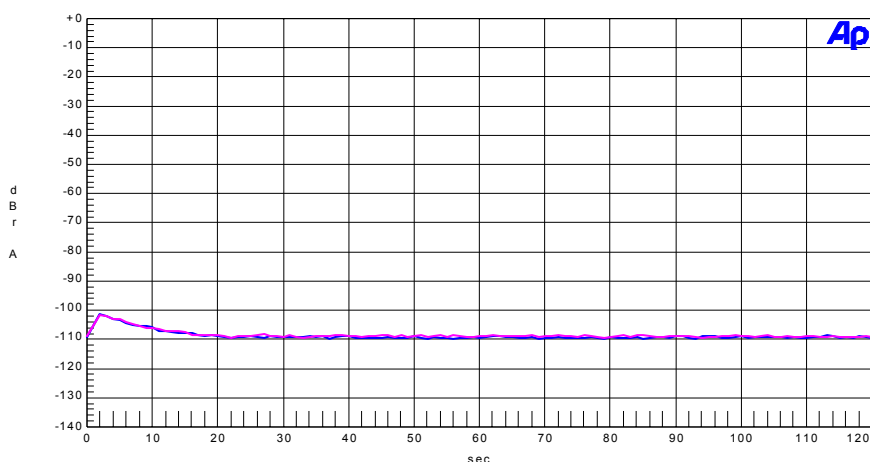
Figure 2-10 Noise Modulation vs. Level

2.15   Speaker Outputs

If the product being tested also contains speaker outputs, please repeat the following tests at the speaker outputs.

Test 3	Reference Level
Test 8	Left/Right Channel Separation
Test 9	Right/Left Channel Separation
Test 10	Frequency Response
Test 11	THD+N vs. Frequency
Test 12	THD+N vs. Level
Test 13	Dynamic Range

Before performing these tests, disconnect each speaker and connect an 8Ω resistive load in its place. Perform Test 3 (Reference Level) and adjust the output to achieve 2.83 Vrms (1 Watt into 8Ω), unscaled. Use this setting as your reference level, and do not adjust the volume control while performing these tests.

2.16   Headphone Output

If the product under test also contains a headphone output, please repeat the following tests at the headphone output.

Test 3	Reference Level
Test 6	Downmix Lt/Rt

Test 7   Downmix Lo/Ro

Test 10   Frequency Response

Test 11   THD+N vs. Frequency

Test 12   THD+N vs. Level

Test 13   Dynamic Range

Before performing these tests, connect a 32Ω resistive load to the headphone output. Perform Test 3, Reference Level, and adjust the output to achieve 75 mVrms (unscaled). Use this setting as your reference level, and do not adjust the volume control while performing these tests.

Chapter 3
Digital Domain Tests

The Digital Domain tests are intended to measure the quality of the digital audio output(s). These outputs should meet all the requirements of the IEC 61937 standard. A Dolby® Digital decoder, such as a multichannel receiver, should decode the output with flawless audio reproduction.

Test all digital audio outputs, both optical and coaxial. Connect the digital audio output from the product under test to the AP System II digital input.

3.1   Test 15: Eye Pattern

Test file: Any program material or test file

AP test: digeye.at2

To begin Test 15, open the AP test file. Make sure your digital audio output is connected to the digital audio input on the AP.

Test 15 measures the zero crossings of the IEC 61937 output. The output is shown as an eye pattern. Closure at the zero crossing results in an increased chance of signal error and jitter. Closure refers to the time period the waveform is at 0V, between the "eyes" of the eye pattern. Closure is measured in nanoseconds. Divide the Closure time by 162 nsec (the eye duration) to obtain the Eye Pattern Closure Ratio in UI (unit intervals).

When the test is complete, save the test file: **File**, **Save As**, **Test**. Record the results for this test on the *Test Results* form.
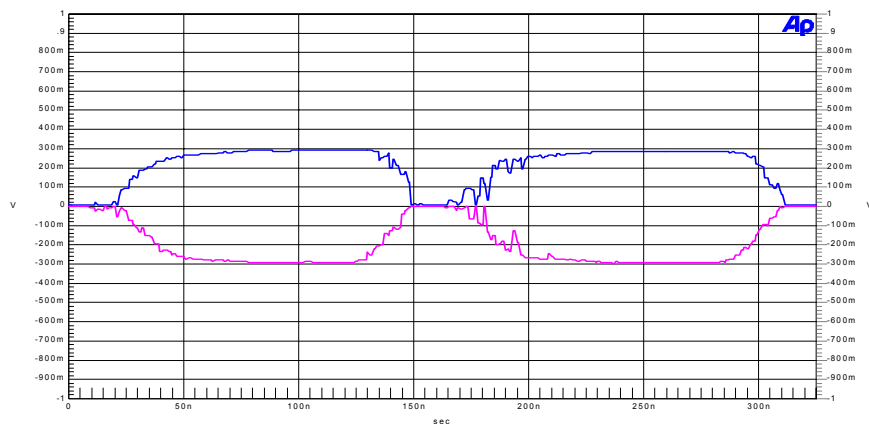

Figure 3-1 Eye Pattern

3.2   Test 16: Jitter Histogram

Test file: Any program material or test file.
AP test: dighist.at2

To begin Test 16, open the AP test file. Make sure your digital audio output is connected to the digital audio input on the AP.

Test 16 measures the relative timing of the three different pulse lengths of the IEC 61937 output. This is displayed as a histogram showing the relative percentage of number of pulses counted at a particular pulse length. Ideally, each of the three peaks in the histogram should be narrow and well defined. The peaks should not come within 50 percent of overlapping each other.

When the test is complete, save the test file: **<u>File</u>**, **<u>Save As</u>**, **<u>Test</u>**. Record the results for this test on the *Test Results* form.

Figure 3-2 Jitter Histogram

3.3   Test 17: Wideband Jitter Spectrum

Test file: Any program material or test file
AP test: digjitw.at2

To begin Test 17, open the AP test file. Make sure your digital audio output is connected to the digital audio input on the AP.

The spectrum of the jitter of the IEC 61937 output is measured and displayed over the bandwidth from 0 to 1500 kHz. Since the clocks for the DACs in the external decoder will probably be derived from the IEC 61937 data stream, jitter in the data stream may affect the audio quality of the decoder output. High-frequency jitter, audio

frequency jitter, or both, may cause degradation of audio quality. The jitter in the IEC 61937 output should be as low as possible.

When the test is complete, save the test file: **File**, **Save As**, **Test**. Identify the frequency and value of maximum jitter. Record the results for this test on the *Test Results* form.

Figure 3-3 Wideband Jitter
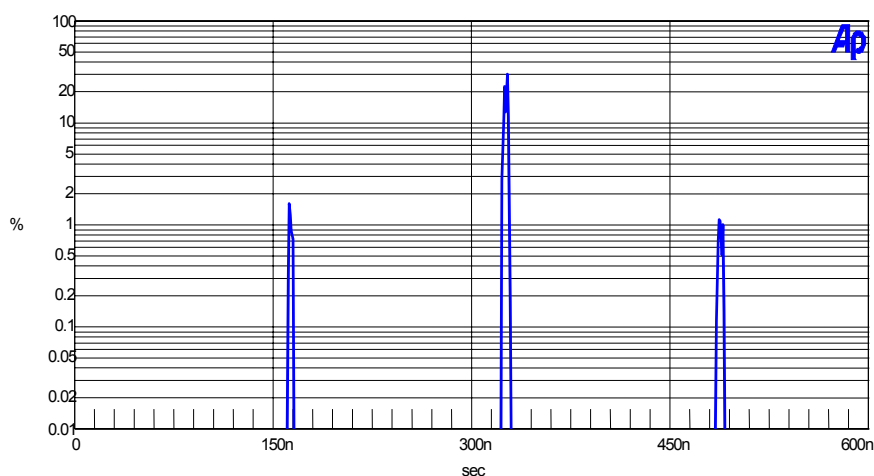
3.4   Test 18: Narrowband Jitter Spectrum

Test file: Any program material or test file
AP test: digjitn.at2

To begin Test 18, open the AP test file. Make sure your digital audio output is connected to the digital audio input on the AP.

The spectrum of the jitter of the IEC 61937 output is measured and displayed over the bandwidth from 0 to 20 kHz. Since the clocks for the DACs in an external decoder will probably be derived from the IEC 61937 data stream, jitter in the data stream may affect the audio quality of the decoder output. Either high-frequency jitter, audio frequency jitter, or both, may cause degradation of audio quality. The jitter in the IEC 61937 output should be as low as possible.

When the test is complete, save the test file: **File**, **Save As**, **Test**. Identify the frequency and value of maximum jitter. Record the results for this test on the *Test Results* form.
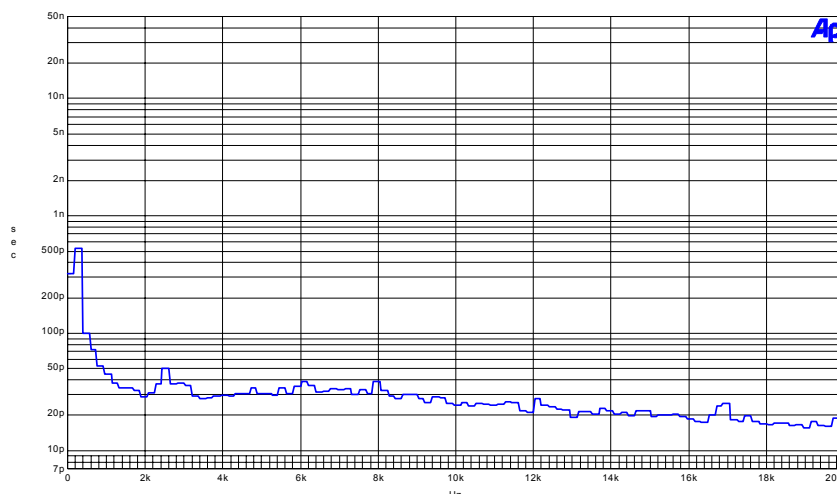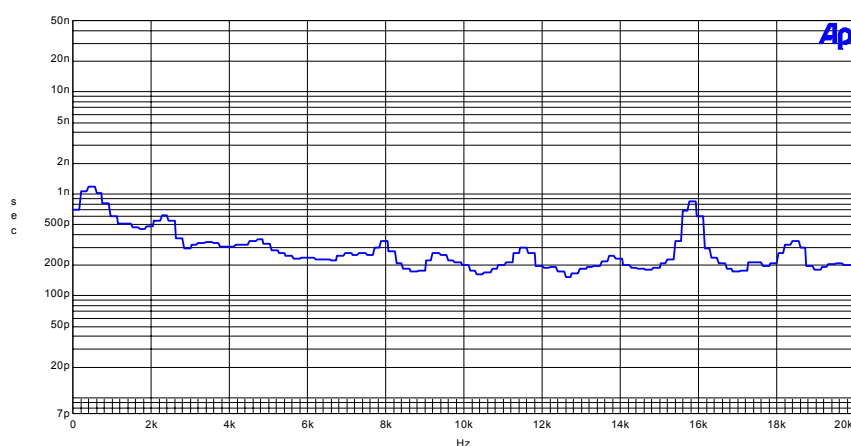
Figure 3-4 Narrow Band Jitter

3.5   Test 19: Category Code

Test file: Any program material
AP test: chanstat.at2

To begin Test 19, open the AP test file. Make sure your digital audio output is connected to the digital audio input on the AP.

The Category Code and the Audio Mode are two specific areas of information to identify in the bitstream. The Category Code indicates the appropriate broadcast environment for the product, for example, setting bits 14-8 to hex 64, representing a category code of USA origination, Digital Broadcast audio.

While playing any test material, confirm that the IEC61937 output from the unit has the Category Code set to US origination, Digital Broadcast, or the Category Code appropriate for the broadcast market for the product.

3.6   Test 20: Audio/Non-Audio Bit

Test file: Any program material
AP test: chanstat.at2

To begin Test 20, open the AP test file. Make sure your digital audio output is connected to the digital audio input on the AP.

The Audio Mode indicates the Audio or Data bitstream settings. The bitstream should indicate Data when delivering Dolby Digital information and Audio when delivering PCM.

Record the results for this test on the *Test Results* form.

While playing any test material, confirm that the IEC 61937 output from the unit has the Audio/Non-Audio bit in the channel status set to Non-Audio.

Record the results for this test on the *Test Results* form.

Chapter 4
Listening and Functional Tests

The following listening and functional tests are meant to provide a practical evaluation of the product. While we consider it important for a product to have the highest possible electrical signal characteristics, we also expect consumers to enjoy using any product with a Dolby® logo. In order to guarantee this enjoyment, the following tests attempt to simulate various broadcast environments. By this method of simulation, it can be determined how the product will perform in these environments.

4.1   Test 21: Difficult Bitstreams

Test File	Mux Channel	Duration	Test Signal Description
difmus1.ac3	Mux 07-3		
difmus3.ac3	Mux 07-4	120 sec	Test stream with variable bit rate and coupling
difmus5.ac3	Mux 07-5		
difmus6.ac3	Mux 07-6		

These signals require maximum decoding processing. The decoder should be able to play the bitstreams without *glitching* or repeating frames.

Test 21 is a listening test. If the decoder has difficulty decoding the bitstreams, the problem will manifest itself as a frame repeat, which sounds similar to a skip of short duration.

Record the result of this test on the *Test Results* form.

4.2   Test 22: Data Rate

Test File	Mux Channel	Duration	Test Signal Description
dtrtall.ac3	Mux 08-3	190 sec	400 Hz at –20 dBFS left channel 32 through 640 kbps

Test 22 is a 400 Hz sine at –20 dBFS in the left channel only, encoded as 2/0, with data rate increasing every ten seconds from 32 kbps to 640 kbps. The data rates are:

32 kbps	64 kbps	120 kbps	256 kbps	512 kbps
40 kbps	80 kbps	160 kbps	320 kbps	576 kbps
48 kbps	96 kbps	192 kbps	384 kbps	640 kbps
56 kbps	112 kbps	224 kbps	448 kbps	

The verification should be done by a listening test, in which case the playback should be continuous and without noticeable artifacts.

Record the results of this test on the *Test Results* form.

4.3   Test 23: Audio Coding Mode

Test File	Mux Channel	Duration	Test Signal Description
acmswpvo.ac3	Mux06-3	70 sec	–20 dBFS Voices encoded in 1/0, 2/0, 2/1, 2/2, 3/0, 3/1, and 3/2
acmodswp.ac3	Mux06-4	70 sec	–20 dBFS Tones encoded in 1/0, 2/0, 2/1, 2/2, 3/0, 3/1, and 3/2

Test 23 checks both the decoder's capability to decode all of the Audio Coding Modes (ACMODs), and the decoder's ability to handle changes in ACMOD. Sounds normally heard in surround channels and center channels are reproduced by downmixing into only the two available channels.

The test signal is at –20 dBFS, encoded in 1/0, 2/0, 2/1, 2/2, 3/0, 3/1, and 3/2 modes. The verification should be done by a listening test, in which case the playback should be continuous and without artifacts. If there is a pause in playback during the transition in coding mode, it should be short, and playback should resume within less than 100 milliseconds.

Listen to both files and record the results of this test on the *Test Results* form.

4.4   Test 24: Program Format Display

Test File	Mux Channel	Duration	Test Signal Description
acmodswp.ac3	Mux06-4	70 sec	–20 dBFS Voices encoded in 1/0, 2/0, 2/1, 2/2, 3/0, 3/1 & 3/2

Perform this test when the unit under test displays the audio decoding mode. Visually observe the user interface, play the test file, and confirm that the indicators correctly sequence through the various program formats: The test file sequences through 1/0, 2/0, 2/1, 2/2, 3/0, 3/1, and 3/2 modes.

Record the results for this test on the *Test Results* form.

4.5   Test 25: Error Concealment

Test File	Mux Channel	Duration	Test Signal Description
ec5.ac3	Mux03-5	30 sec	Bitstream with errors

Test 25 assesses the decoder during playback of bitstreams with errors. While playing ec5.ac3 through the unit being tested the following results are acceptable:

- Block repeats
- Mutes

The following results are unacceptable:

- Loud noises
- Unit stops decoding

Record the results of this test on the *Test Results* form.

4.6   Test 26: Advanced Bitstreams

Test File	Mux Channel	Duration	Test Signal Description
advnc1.ac3	Mux 02-4	64 sec	
advnc2.ac3	Mux 09-3	60 sec	Bitstream with advanced features
advnc3.ac3	Mux 09-4		
advnc4.ac3	Mux 09-5		

This test is to assess the decoder during playback of bitstreams encoded with advanced features. While playing the test file through the unit being tested, note any of the following events:

- Block repeats
- Mutes
- Loud noises
- Unit stops decoding

Record the results of this test on the *Test Results* form.

4.7   Test 27: External Decoder Compatibility

Test File	Mux Channel	Duration	Test Signal Description
difmus1.ac3	Mux07-3	120 sec	Test stream with bit rate and coupling

To begin Test 27, make sure your digital audio output is connected to the digital audio input on the external decoder.

The IEC61937 output should be compatible with any external Dolby® Digital decoder. Connect a Dolby DP564 decoder or other commercially available decoder, and play test

program material. If possible use a variety of external decoders. The decoder should be able to decode the Dolby Digital bitstream with no difficulty for a passing result.

Record the results of this test on the *Test Results* form.

4.8   Test 28: External Decoder Latency

Test File
Use the A/V Sync disc included in the test kit

To begin Test 28, open the AP test file. Make sure your digital audio output is connected to the digital audio input on the AP.

The difference in time (latency) for an external Dolby Digital decoder and the two-channel product to decode the same incoming bitstream should be nearly zero.

1. Connect the product under test's digital audio output to an external Dolby Digital decoder. We recommend the use of a Dolby Laboratories DP562, or similarly characterized external decoder.

2. Connect the left analog output of each decoder to an oscilloscope, preferably a digital storage oscilloscope.

3. Play the test file. Monitor both channels of the oscilloscope, and determine the time difference between them.

The analog audio output from the external decoder should be within 5 milliseconds *earlier,* and 15 milliseconds *later* than the analog output of the two-channel decoder under test. This ensures that when the product is used with an external decoder, sync between video and audio will not be affected by the difference in decoding times.

Record the results of this test on the *Test Results* form.

4.9   Audio Format Switching

The following tests check the audio format switching capability of the design. These tests apply to products receiving broadcasts with programs having audio information other than Dolby Digital. They also apply to products that receive both analog and digital programming.

The success of the switch is monitored at the analog and digital outputs. Channel switches to MPEG-2 transport streams carrying different audio elementary streams should occur without objectionable noises, sounds, or differences in apparent loudness. This type of switch can occur when changing channels. It can also occur in

a single transport stream carrying Dolby Digital information and audio information of another type.

4.9.1   Test 29: Automatic Switching

Test 29 checks the ability of the product to automatically switch between audio elementary streams in the MPEG-2 transport stream. The product should auto-select one audio format available in the transport stream and pass it through to the S/PDIF output.

1. Deliver a transport stream with the following audio into the product being tested.

    - Dolby Digital only
    - MPEG audio only
    - Dolby Digital and MPEG audio

2. Monitor digital output through an external decoder for each stream.

3. Indicate Dolby Digital or PCM format on the *Test Results* form.

4. Verify audio availability at the analog outputs on the *Test Results* form.

4.9.2   Test 30: Manual Switching

Test 30 checks the ability of a product to switch between audio elementary streams in an MPEG2 transport format by remote control or other user interaction.

1. Deliver a transport stream including Dolby Digital to the product being tested.

2. Select the audio operating mode that indicates Dolby Digital decoding.

3. Monitor the decoded audio from the analog outputs.

    - Is audio present at the analog outputs?
    - Note audible decoding errors.
    - Record results on the *Test Results* form.

4. Monitor digital output through an external decoder.

5. Indicate Dolby Digital or PCM format on the *Test Results* form.

6. Select the audio operating mode that indicates MPEG or other audio format decoding.

7. Repeat steps 3 and 4.

If product does not default to Dolby Digital decoding, please indicate this on the *Test Results* form.

4.10   Broadcast Format Verification

The format verification test assures that Dolby Digital is delivered to both the S/PDIF and the analog line outputs independent of the broadcast format. Verify the reception of broadcast formats supported by the product. Formats supported might include:

- Cable
- DSL
- Satellite
- Terrestrial

4.10.1   Test 31: Analog Listening Test

1. To perform Test 33, input a program using Dolby Digital to the selected input of the product being tested.
2. Connect the L/R line outputs to an audio playback system.
3. Verify proper Dolby Digital decoding.

Record results on the *Test Results* form.

4.10.2   Test 32: S/PDIF Output to Dolby Digital Decoder

1. Input a program featuring Dolby Digital to the selected input of the product being tested.
2. Connect the S/PDIF output to an external Dolby Digital decoder. Verify proper Dolby Digital bitstream decoding at the output of the external decoder. Record results on the *Test Results* form.

4.11   Test 33: Level Comparison

In Test 33, compare the audio levels between all available formats. Example formats are:

- ATSC/NTSC
- DVB/PAL
- Dolby Digital/MPEG audio (satellite receivers)

1. To perform the audio level listening test, connect the product under test to antenna inputs for two different formats.
2. Receive and select one channel from each format. If possible find different formats on adjacent channels. (i.e., ATSC and NTSC).

3. Switch between the channels; listen and compare the audio from all analog outputs, including RF output. Repeat (3) at the digital audio output

4. Note the level difference between the formats and record the results on the *Test Results* form.

Note: The dialog levels, for each format listed above, can be measured using the Dolby Laboratories LM100 Broadcast Loudness Meter

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4.12 Test 34: Downmix 5.1 vs. Two-Channel Output Level

Compare output amplitude when the input changes from 5.1- to two-channel programming. Proper operating mode (RF and Line) design will ensure very little difference in output amplitude.